

## Spontaneous capital femoral physeal fracture in a cat

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**Abstract** — A young neutered male cat was presented with a 1-week history of left hind limb lameness. Pain and crepitus were identified on manipulation of the left coxofemoral joint. Radiographic evaluation led to the diagnosis of physeal dysplasia with slipped capital femoral epiphysis of the left femur, which did not respond to conservative management.

**Résumé** — **Fracture physaire fémorale proximale spontanée chez un chat.** Un jeune chat mâle stérilisé a été présenté avec une anamnèse de 1 semaine de boiterie de la patte arrière gauche. La douleur et la crépitation ont été identifiées à la manipulation de l'articulation coxo-fémorale. L'évaluation radiographique a permis de poser un diagnostic de dysplasie physaire avec un glissement de l'épiphyse fémorale proximale du fémur gauche, qui n'a pas répondu à une gestion conservatrice.

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### Case description

A 13-month-old, neutered, male domestic shorthair cat was presented for left hind limb lameness of approximately 1-week duration. Owners reported improvement in the lameness after a few days of rest, but when normal activity resumed, the lameness returned. The cat vocalized when it was picked up. The 4.9-kg cat was neutered and declawed at 6 mo of age and was an indoor cat with no history of trauma. On physical examination, pain and crepitus were evident on palpation of the left coxofemoral joint. All other body systems were within normal limits. Differential diagnoses included femoral head/neck fracture and coxofemoral dysplasia. Osteomyelitis and neoplasia were considered as well but were less likely due to age and absence of other clinical signs.

The cat was admitted and a ventrodorsal radiograph indicated a fracture at the femoral capital physis of the left hind limb with separation of the femoral head at the level of the growth plate and resorption of bone in the femoral neck (Figure 1). The right coxofemoral joint was not fractured but there appeared to be an irregular open physis and decreased bone opacity along the femoral neck. A diagnosis of proximal femoral physeal fracture was made. The growth plate of the ischial tuberosity was noted to be open on radiographs and the pelvic symphysis and sac-

roiliac joint had not fused. A femoral neck and head excision was recommended for the left hind limb with pre-operative radiographs to reassess the right coxofemoral joint. The owners opted for conservative management, monitoring the level of pain, and proceeding with surgery if the condition worsened.

Two months after initial presentation, the cat was prescribed meloxicam (Metacam Oral Suspension for Cats; 0.5 mg/mL Boehringer-Ingelheim, Burlington, Ontario), 0.05 mg/kg body weight (BW), q24h with food for 1 wk to relieve pain. On re-check examination 1 wk after starting meloxicam, the owners reported improved activity level. However, both coxofemoral joints were painful upon palpation, suggesting a possibility of this being a bilateral condition. The cat had lost 1.1 kg body weight which was attributed to the significant pelvic muscle atrophy observed. Surgical treatment with excision of the femoral head and neck was discussed, indicating bilateral surgery would most likely be required. The owners agreed to proceed with surgery. Preoperative blood work, a complete blood cell count and a biochemical profile (ANTECH Diagnostics Canada, Mississauga, Ontario), revealed all parameters to be within normal limits.

Pre-operative radiographs were taken 3 mo after initial presentation to determine whether bilateral surgery was required. Radiographs revealed spontaneous fracture of both capital physes (Figure 2). Resorption and remodeling at the fracture site was also evident, indicating chronicity of the disease process.

The owners were concerned with costs associated with bilateral surgery and post-operative rehabilitation and elected to euthanize the cat. A diagnosis of feline physeal dysplasia with slipped capital physis was made, since there was no evidence of trauma. However without a biopsy, this could not be confirmed.

### Discussion

Spontaneous capital physeal fractures tend to be chronic and insidious with no history of trauma (1). Both hind limbs may be

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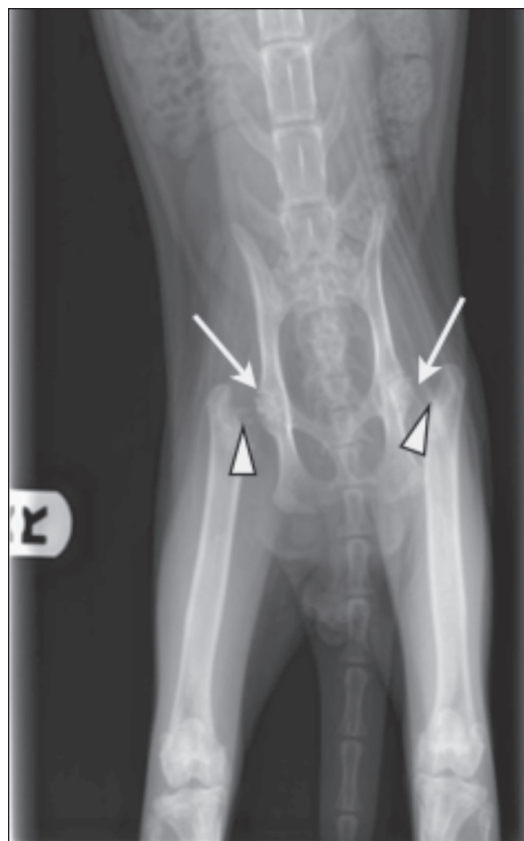


**Figure 1.** Ventrodorsal radiograph of the cat demonstrating a spontaneous femoral capital physal fracture (arrow) of the left hindlimb with evidence of osteolysis (arrowhead) of the femoral neck.

simultaneously affected or the contralateral limb may be affected at a later date. In contrast, traumatic fractures are typically caused by traffic accidents or falls and are most commonly seen in young male cats that generally present with acute unilateral hind limb lameness. If the fracture occurs at the growth plate and causes a slipped epiphysis, it is classified as a Salter Harris type 1 fracture (2). One study showed that femoral neck fractures are more common in cats under 6 mo of age, while capital epiphyseal separation and femoral neck fractures had equal frequency of occurrence in cats between 6 and 12 mo old (3). No cats older than 12 mo had traumatic capital epiphyseal separation. This pattern is likely due to closure of growth plates occurring between 7 to 10 mo of age and that under 6 mo of age the bone of the femoral neck is weaker than the cartilage of the growth plate (3).

Certain risk factors for physal dysplasia with slipped capital femoral epiphysis (SCFE) have been identified. In a study of 26 cats with spontaneous femoral capital physal fractures, 96% were neutered males (4) and affected cats had a greater mean weight than control cats (4). These risk factors are consistent with other studies (2,5). All studies consistently report the condition in young cats ranging from 4.5 to 42 mo old, with an average age of 16 to 22 mo (2,4,5). Siamese cats may have increased prevalence (2).

The association of physal dysplasia with early gonadectomy is thought to be due to the interaction of gonadal steroids with



**Figure 2.** Ventrodorsal radiograph of the cat 3 months after initial presentation. Bilateral fractures (arrows) at the capital femoral physes are present with resorption and remodeling (arrowheads) of the femoral neck.

the closure of physes (6,7). High levels of estrogen inhibit growth and stimulate physal closure through promoting degeneration of hypertrophied chondrocytes and calcium deposition. Early gonadectomy delays radial physal closure in male and female cats or dogs neutered at 7 wk or 7 mo (6,8). Physal closure is delayed in castrated males compared to intact males and females, whether spayed or intact (7). This is thought to be due to the fact that in males, Leydig cells within the testes are predominantly responsible for androgen production, while in females androgens are mainly produced by the adrenal cortices (7). Nonetheless, delayed physal closure due to early neutering cannot explain all cases of this syndrome as intact male and female cats may also be affected (2,9).

Cats affected with SCFE have a higher average weight than control cats (2,4). Several authors have demonstrated no association between age at gonadectomy and prevalence of obesity (10,11), although sexually intact cats weighed significantly less (10,12,13) and had less falciform fat than cats which underwent gonadectomy at 7 wk or 7 mo (10). Other factors proposed to be responsible for increased weight gain in neutered cats include increased food intake (12), alterations in energy expenditure (14), and increase in insulin levels (12).

Diagnosis of SCFE is based on assessment of risk factors, clinical signs, radiographic evaluation, and histology. Clinical signs include lameness, weakness, decreased ability to jump, muscle atrophy, and pain and crepitus on extension and flexion

of the coxofemoral joint (1,4). Assessment of both femurs should be performed as the condition is bilateral in 19% to 38% of cases (1,2,4).

Radiographic evaluation of the coxofemoral joint reveals capital physal incongruity and femoral neck resorption (1,4,5,15). Ventrodorsal projections of the pelvis may be sufficient; but a flexed or "frog-legged" view is preferred as the fracture will not be reduced into position by artificially tightening the joint capsule (1,15). Displacement at the fracture site (displacement of the femoral epiphysis in relation to the metaphysis) can range from minimal or no displacement to varying degrees of craniodorsal displacement (4). Varying degrees of femoral neck osteolysis and sclerosis have been observed, with chronic cases associated with increased severity of both (4,5). Serial radiographs demonstrate progression of the resorption and sclerosis (4), similar to what was seen in this clinical case. Osteolysis occurs at the femoral neck and can vary from alterations in bone opacity to resorption of both the dorsal and ventral aspects of the femoral neck, creating a narrowing of the femoral neck (4,15).

Evaluation of radiographs for open physes is necessary as cats with SCFE may have delayed closure of other growth plates. Most notable are the contralateral capital femoral, the distal femoral, and the proximal tibial physes (1,4,9), which are expected to close in cats between 30 to 40 wk, 54 to 76 wk, and 50 to 76 wk, respectively (16).

Metaphyseal osteopathy in cats has similar risk factors to physal dysplasia (1,4,17). Resorption is thought to occur primarily in the femoral neck leading to secondary epiphyseal separation (17). Progressive osteolysis and sclerosis occur secondary to physal fracture, suggesting that the metaphyseal osteopathy may be a more chronic and advanced state of SCFE (1,4,15).

Histological examination of the femoral head and neck can confirm the diagnosis (9). Epiphyses removed from affected cats contain normal articular cartilage and viable bone with attached growth plate cartilage (2,4), indicating that the femoral capital physis was still open at the time of the fracture. The affected physis is approximately twice the width of a normal physis (1–4,9). Evaluation of the cartilage showed that chondrocytes lack their columnar arrangement and appear in groups randomly dispersed throughout the abundant extracellular matrix (1,2,4,9). The site of "slippage" tends to be in the center of the physis, surrounded by necrotic cartilage (9). Alcian blue and PAS staining of the growth plates showed that the femoral neck contains viable metaphyseal bone, chondrocyte clusters, and necrotic cartilage at the fracture site and that the chondrocytes are polygonal shape and lack cytoplasm and cytoplasmic glycogen (2). Abnormal chondrocytes in other open physes suggest that the abnormalities were present before "slippage" and the changes are not an effect of the fracture (9). By contrast, in traumatic physal fractures the fracture line can extend through multiple zones of cartilage but chondrocytes retain their columnar arrangement on both sides of the fracture (2,9). Delayed physal closure, weight gain, and the presence of dysplastic chondrocytes suspected to be associated with prepubertal castration result in an abnormal, open, and wide physis that cannot withstand the forces of normal activity (2,4,18).

Treatment for proximal femoral fractures may be conservative or surgical (1). Conservative management is unlikely to be

effective in the presence of osteolysis and remodelling and can lead to dysfunction. Surgical treatment is preferred in order to maintain limb function. Surgical options include stabilization with K-wires or femoral head and neck excision (FHNE). The use of K-wires to reduce and stabilize the femoral head and neck needs to be done within the first 3 to 4 days of the fracture prior to radiographic evidence of remodelling. In most cases of SCFE, FHNE is recommended (1). A good to excellent outcome following FHNE has been reported and many cats regain normal use of the affected limb (1,18). In some cases, limb shortening and decreased range of motion can lead to persistent gait abnormalities. Patients which show clinical signs for longer than 6 mo and show muscle atrophy are expected to have a poorer outcome (1,19).

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